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THIS PAPER DESCRIBES A CLOSED CIRCUIT TELEVISION SYSTEM USED FOR LECTURES AND LABORATORY DEMONSTRATIONS IN MEDICAL PHYSIOLOGY FOR FIRST YEAR MEDICAL STUDENTS. (LH)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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A CLOSED-CIRCUIT DATA BROADCAST SYSTEM *

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In support of the teaching program in medical physiology at Baylor University Medical College, a closed-circuit broadcast system has been developed. Television, two-way audio signals and physiological data can be sent over the network which connects the department of physiology with various laboratories and institutions in the Texas Medical Center. The extent of the system (January 1, 1963) is diagrammed in figure 1. All stations in this network can originate or receive programs which are in essence Broadcast Demonstrations. The following is a brief summary of the system. Descriptions of the individual stations can be found in the articles cited in the bibliography.

Principally, the audience consists of first year medical students who are either working in groups of four in their laboratories (fig. 2) or assembled in the main lecture room (fig. 3). The equipment at each of the twenty stations in the student laboratory consists of a three channel physiograph flush-mounted in the table top and a wall-mounted console which houses the audio facilities (left), the television tube (right) and the physiological data broadcast lines (center). To conduct laboratory experiments the physiographs are connected to transducers which in turn are attached to an experimental animal on the table shown at the right of figure 2. To receive broadcast demonstrations, the cables which are used to connect the transducers to the physiograph channels are alternatively plugged into the jacks in the center of the console on the

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wall. Thus, all channels of the twenty physiographs in the laboratory can be "slaved" to the broadcast system.

The lecture room (fig. 3) accommodates 100 students and is also employed for broadcast demonstration purposes. In this area are a ceiling-mounted projection television (upper left) and a ceiling-mounted camera (upper right). A physiograph is installed in a specially designed bench in front of the screen and blackboard.

To mix the signals fed to these two primary receiving areas, a master control room was constructed (fig. 4). On the right of the console are the television switching facilities, monitors, camera controls, a tuner and a synchronizing generator. In the center is a multi-channel oscilloscope surrounded by meters which monitor all incoming lines.

The most frequently used studio is the Demonstration Room (fig. 5), which accommodates 20 people. In it are installed two television cameras and monitors, along with a physiograph flush-mounted in a cabinet. To the right of the cabinet is the table for the experimental animal. One camera is used to monitor the record while the other provides coverage of the experiment itself.

Under construction are seven graduate research laboratories which are due to be completed by the middle of 1963. Each laboratory (fig. 6) will house two investigators. In these areas will be recording instruments appropriate for the research carried out in them. All seven units will be connected to the master control room. Thus, all research findings which are appropriate in the teaching program will be immediately available to the students.

As they are routinely recorded, clinical electroencephalograms (EEG's) are also utilized for teaching purposes. The EEG laboratory, (fig. 7) which uses standard

commercial instruments, is connected to the broadcast system. Any three of the eight channels being recorded can be transmitted to the network thereby permitting each student to obtain an original record from the patient under study without inconvenience to the patient or the laboratory personnel. This particular feature has proven of special value in teaching the principles of clinical electroencephalography to residents and post-graduate fellows.

At the Texas Institute for Rehabilitation and Research one-half mile from the medical school, cardio-respiratory and many other measurements are routinely made on critically ill patients. The laboratory in which these investigations are carried out is designated the Center for Vital Studies (fig. 8). Two television cameras cover the patient and the instructor. Any three of the six channels of data can be transmitted to the network for teaching purposes.

In the same institution, a patient monitoring system is being developed. The basic components are almost identical with the equipment shown in the Mobile Station illustrated in fig. 9. A feasibility study has demonstrated the practicality of transmitting physiological data from the bedside to the student laboratories over a wire circuit, much in excess of a half-mile in length.

Located approximately one-half mile away in another direction is the City-County Hospital now nearing completion. In certain areas such as operating rooms, recovery rooms and intensive care units, physiological data will be recorded. To these areas ducts and conduit has been installed. When it becomes desirable to use this clinical material for teaching purposes, cable will be installed to connect this institution to the closed circuit broadcast network.

It is frequently desirable to demonstrate a phenomenon or preview an experiment before the assembled class. In most cases, viewing a record of physiological events as

they change during a period of a few seconds is of primary importance. When this is desirable, the broadcast facilities in the main lecture room provide a means of permitting all to experience the event as it occurs and analyze it at leisure with the instructor. This is accomplished by recording directly from the experimental subject with the physiograph built into the lecture room cabinet. This record is also transmitted to the demonstration room where it is televised and rebroadcast back to the television projector in the lecture room. Thus, all see a copy of the record that is being recorded in front of them. While the phenomenon undergoes its change and is being discussed by the instructor, the original record is sampled and thermofax projection transparencies are made. After the event returns to control levels, the transparencies are projected and the recordings just witnessed are analyzed for the data they contain.

E. E. G. demonstrations and those from the Texas Institute for Rehabilitation and Research are often handled in the manner described above. The signals from the clinical areas are broadcast to the demonstration room and then televised for viewing in the main lecture room. They are also sent to the recorder in the same room where they are used to make transparencies for subsequent study.

All data in the network are transmitted over wire. No microwave, carrier or telemetry circuits are used. The number of conductors connecting all stations is shown in fig. 9.

In concluding this brief report, the authors wish to point out that the system is not employed to separate the medical student from the patient, rather the goal in its use is to bring a variety of physiological events deranged by disease to the medical student in his first year of study when courses rather than concepts are often paramount in the mind of the student.

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FIGURE LEGEND

Fig. 1 Broadcast Demonstration Facilities

Fig. 2 Student Laboratory Station

Fig. 3 Lecture Room

Fig. 4 Master Control Room

Fig. 5 Physiology Demonstration Room

Fig. 6 Graduate Laboratory

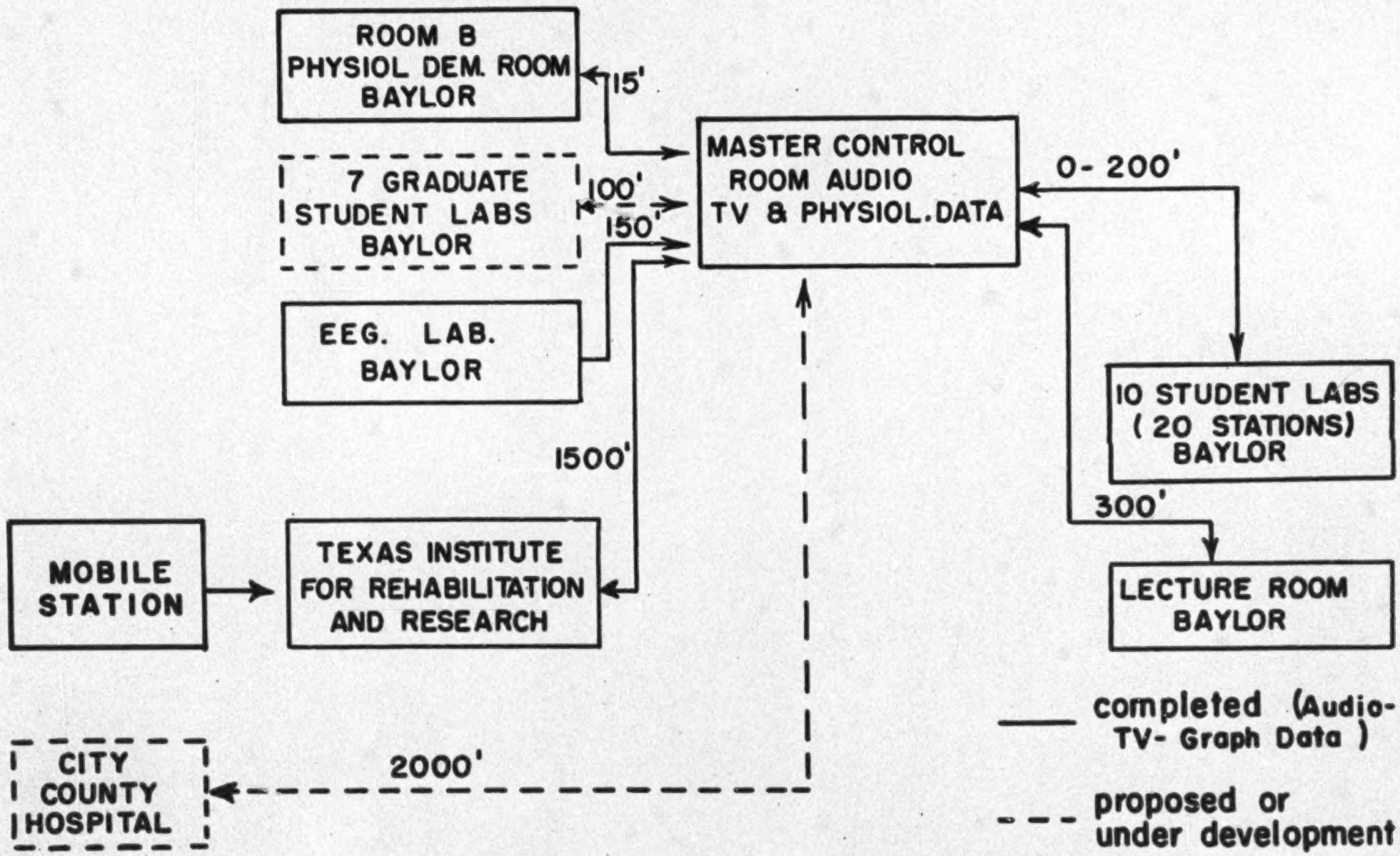
Fig. 7 E. E. G. Laboratory

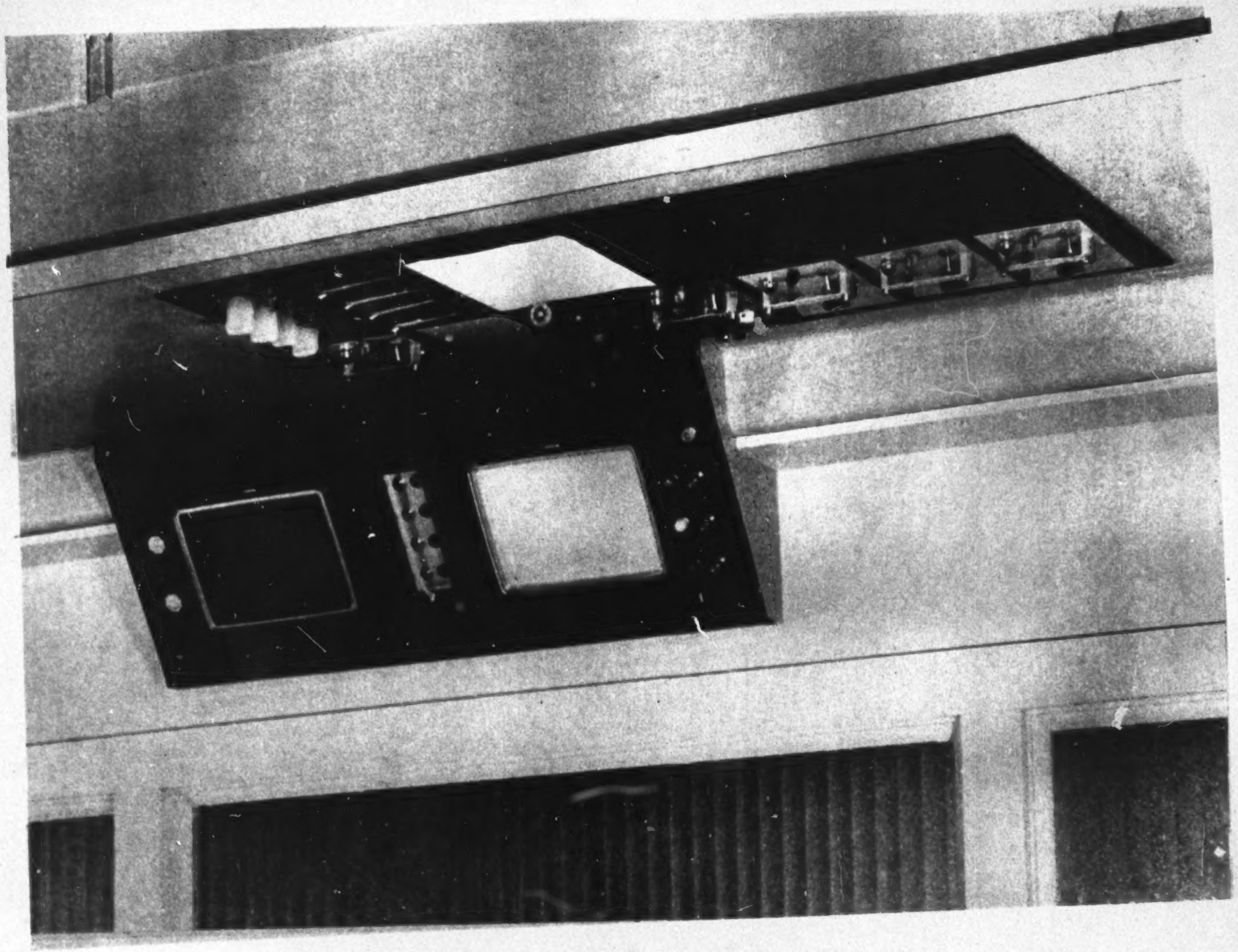
Fig. 8 Center for Vital Studies at the Texas Institute for Rehabilitation and Research

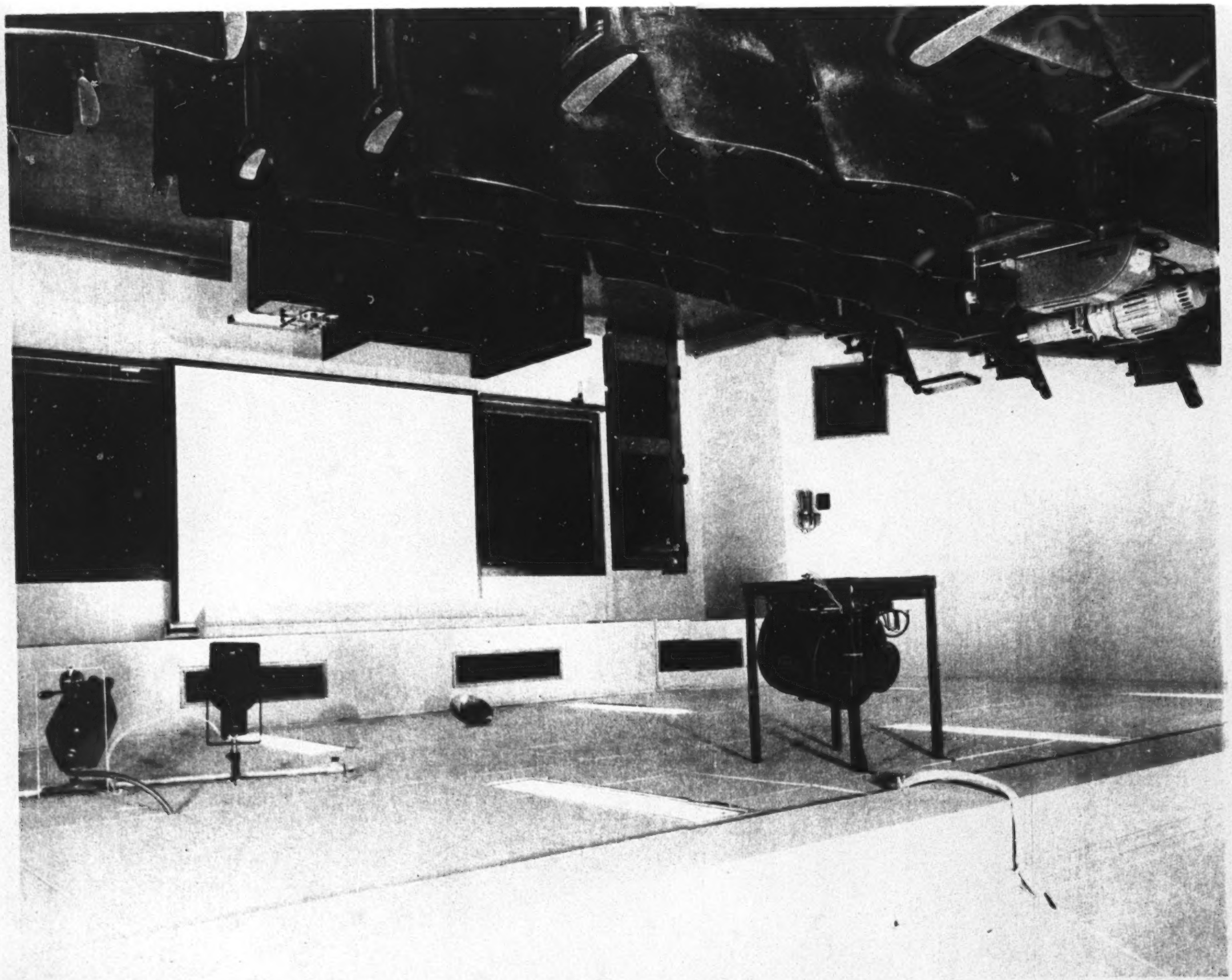
Fig. 9 Mobile Station

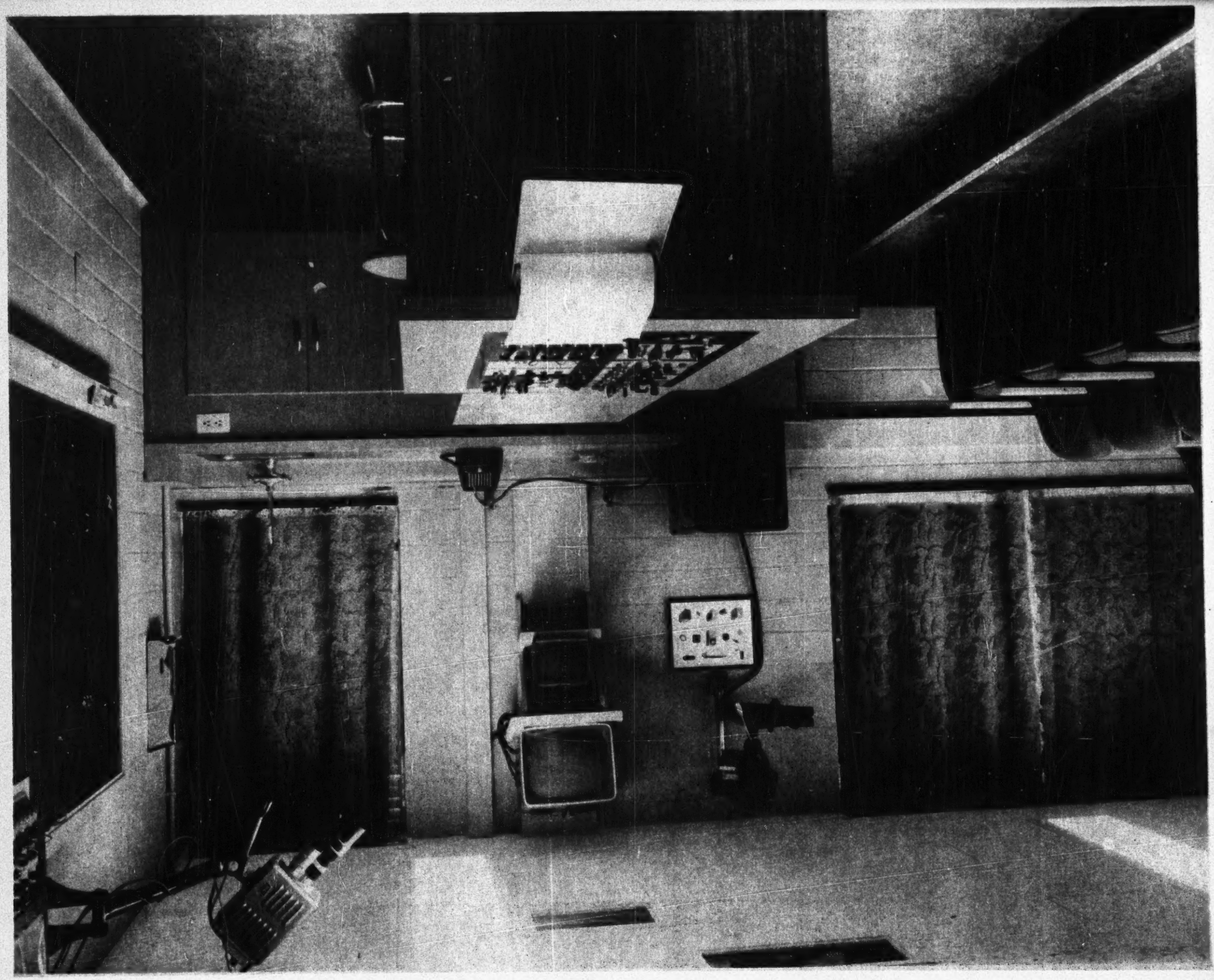
BROADCAST DEMONSTRATION FACILITIES (Audio-TV-Graphic Data)

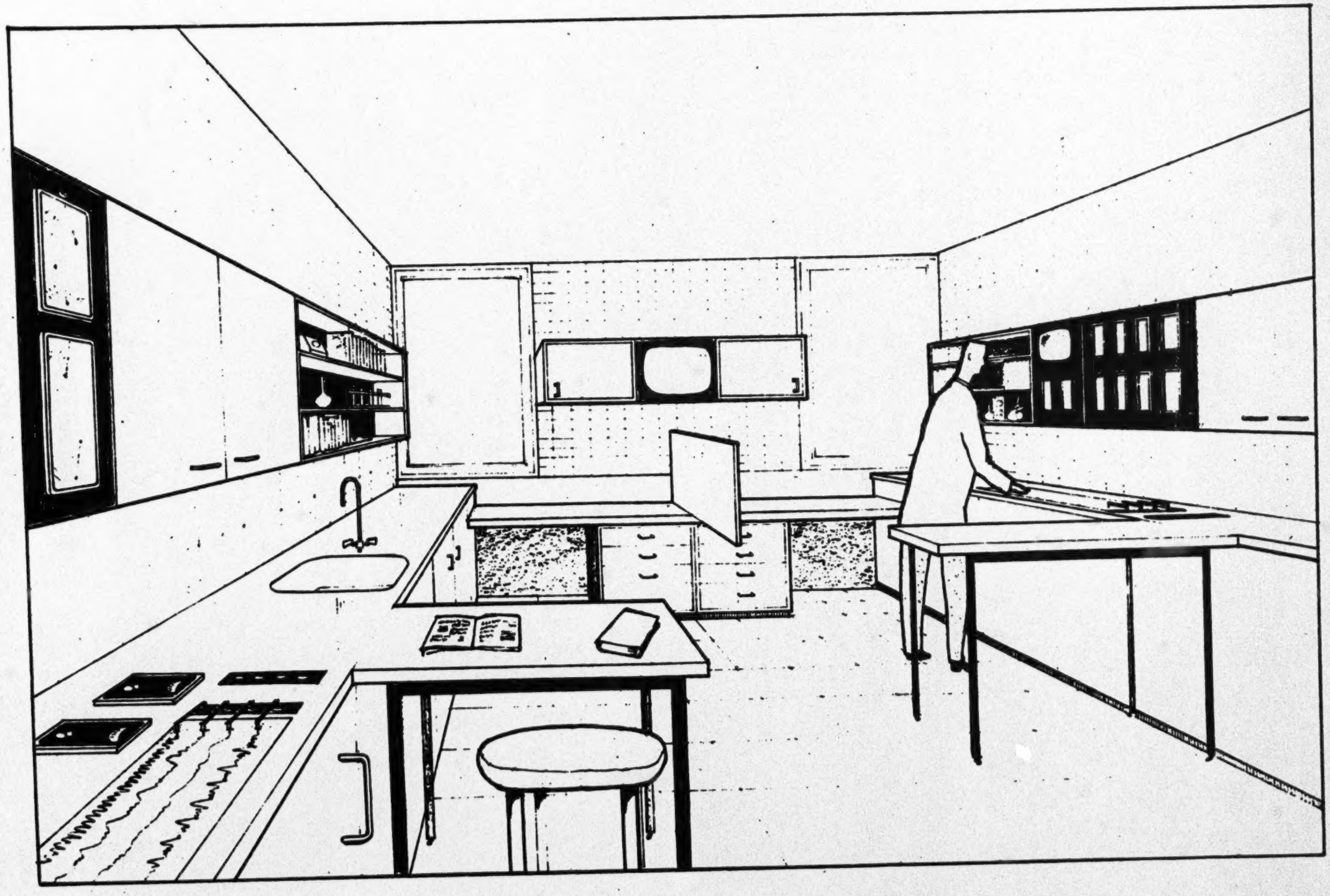
Dept. of Physiology

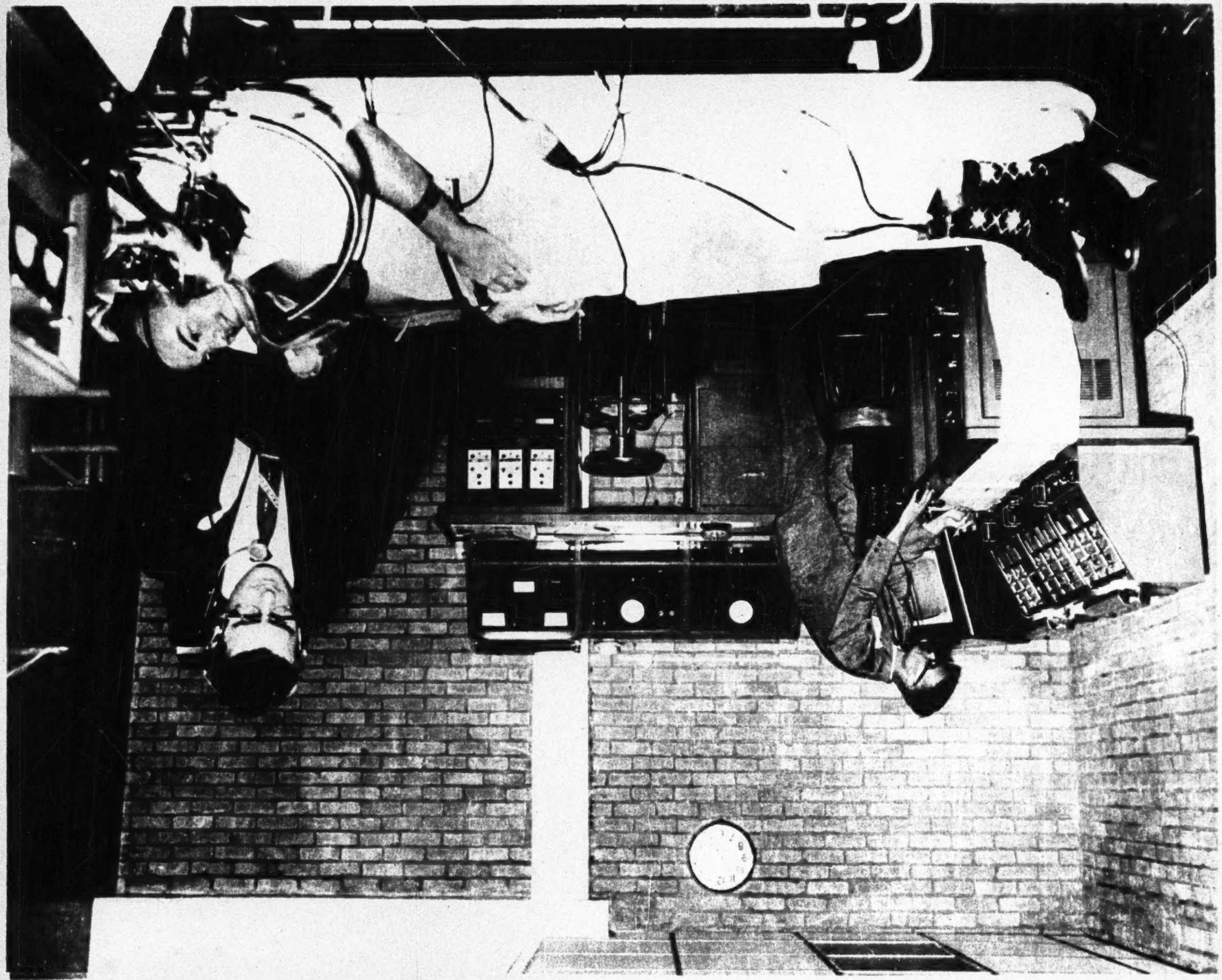


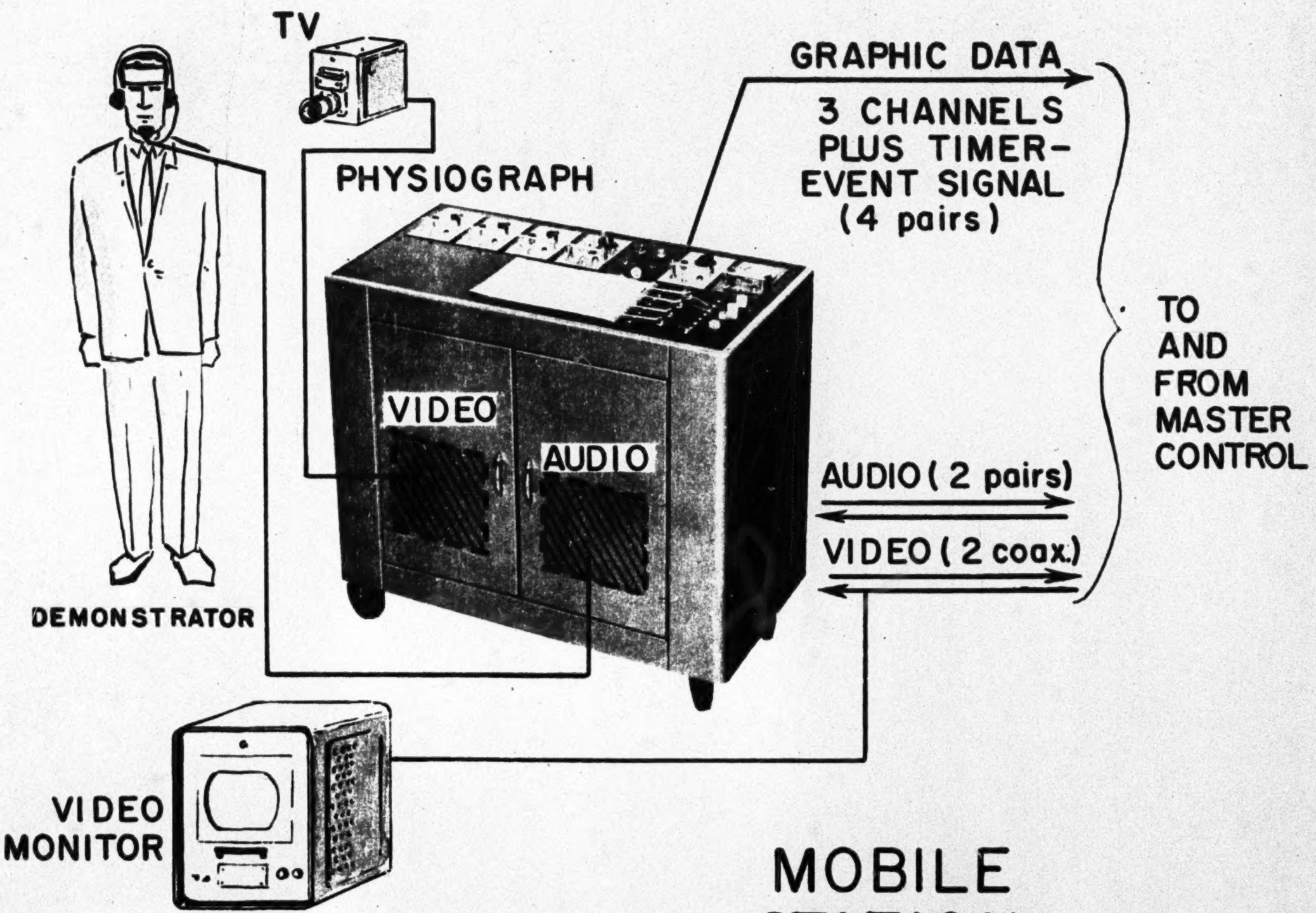












MOBILE STATION